

Trophic Structure and Productivity of the lagoonal communities of Tikehau atoll (Tuamotu Archipelago, French Polynesia)

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Abstract

Carbon standing stocks and fluxes were studied in the lagoon of Tikehau atoll (Tuamotu archipelago, French Polynesia), from 1983 to 1988.

The average POC concentration ($0.7\text{--}2000\ \mu\text{m}$) was $203\ \text{mg C m}^{-3}$. The suspended living carbon ($31.6\ \text{mg C m}^{-3}$) was made up of bacteria (53%), phytoplankton $<5\ \mu\text{m}$ (14.2%), phytoplankton $>5\ \mu\text{m}$ (14.2%), nanozooplankton $5\text{--}35\ \mu\text{m}$ (5.7%), microzooplankton $35\text{--}200\ \mu\text{m}$ (4.7%) and mesozooplankton $200\text{--}2000\ \mu\text{m}$ (7.9%). The microphytobenthos biomass was $480\ \text{mg C m}^{-2}$.

Suspended detritus (84.4% of the total POC) did not originate from the reef flat but from lagoonal primary productions. Their sedimentation exceeded phyto-benthos production.

It was estimated that 50% of bacterial biomass was adsorbed on particles. The bacterial biomass dominance was explained by the utilisation of 1) DOC excreted by phytoplankton ($44\text{--}175\ \text{mg C m}^{-2}\ \text{day}^{-1}$) and zooplankton ($50\ \text{mg C m}^{-2}\ \text{day}^{-1}$) 2) organic compounds produced by solar-induced photochemical reactions 3) coral mucus.

50% of the phytoplankton biomass belongs to the $<5\ \mu\text{m}$ fraction. This production ($440\ \text{mg C m}^{-2}\ \text{day}^{-1}$) exceeded phyto-benthos production ($250\ \text{mg C m}^{-2}\ \text{day}^{-1}$) when the whole lagoon was considered.

The zooplankton $>35\ \mu\text{m}$ ingested $315\ \text{mg C m}^{-2}\ \text{day}^{-1}$, made up of phytoplankton, nanozooplankton and detritus. Its production was $132\ \text{mg C m}^{-2}\ \text{day}^{-1}$.

Introduction

Recent upward revisions in estimates of biomass per bacterium indicate that many earlier biomass values may have to be almost doubled and that bacteria are major components of marine systems (Fuhrman *et al.*, 1989). In addition to the classic type of grazing food web (phytoplankton-zooplankton-fish), a 'microbial loop' (phytoplankton-bacteria-heterotrophic flagellates or protozooplankton) was described by Azam *et al.* (1983). A

stratified, oligotrophic water column may give rise to dominance of small phytoplankters, relatively high DOM-production rates and a long 'microbial loop' type of food chain (Kjørboe *et al.*, 1990).

Polynesian atoll lagoons are located in oligotrophic waters and dominance of small phytoplankters (cyanobacteria) was demonstrated in the atoll of Tikehau by Blanchot *et al.* (1989). In such shallow ecosystems, benthic primary production can play an important role. Charpy-Roubaud (1988) observed that microphyto-

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